



**Mass: Evolving Tool of the U.S.
Operational Artist**

**A Monograph
by
Major J. Marc LeGare
Infantry**



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ABSTRACT

MASS: EVOLVING TOOL OF THE U.S. OPERATIONAL ARTIST
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This monograph discusses the change in the use of mass by U.S. operational artists. As GEN Donn Starry observed, use of military force is based on certain operational concepts. If this is true and the traditional US concept of mass is limited by domestic fiscal and global threat requirements, then one would expect a change in the US use of military force. By discussing the operational-level employment of mass in the US Civil War, WWII European Theater, and Operation Desert Storm, it is shown that US operational artists will probably strive to create the same effects of past mass use, despite a decrease in the means of mass. Maneuver, asymmetric attack, and combined operations are but three methods for achieving similar large-mass effects, required by the US operational-level warfighting style.

This monograph is divided into two sections. The first section discusses the "physics" of mass and related equations. It also includes the "theory" of mass developed from Napoleonic warfare by Clausewitz and Jomini. The last part explains how Grant's 1864 Campaign set the stage for a unique US concept of mass, much different from its Napoleonic counterpart. The second section uses three test criteria to explore further changes in the use of mass. Two campaigns are used - WWII European Theater and Operation DESERT STORM.

Table of Contents

I. INTRODUCTION	1
II. MASS IN SCIENCE AND THEORY	3
Mass in Science	3
Mass in Theory	6
Napoleon	6
Clausewitz	8
Jomini	10
US Civil War - Point of Departure	14
III. ANALYSIS AND EVALUATION	20
Test Criteria	20
1864 Campaign as Baseline	21
WWII European Theater	22
Doctrine	23
Application	26
Operation DESERT STORM	33
Doctrine	34
Application	36
IV. CONCLUSION	42
Tables:	
I. Test Criteria Summary Chart	41
ENDNOTES	44
BIBLIOGRAPHY	50

...If one is genuinely convinced that a great deal can be achieved by a significant superiority, this conviction is bound to influence the preparation for war. The aim will then be to take to the field in the greatest possible strength, either in order to get the upper hand, or at least in order to make sure that the enemy does not.¹

I. INTRODUCTION

Clausewitz wrote these lines in the late 1820's as he reviewed the effect of Napoleon's campaigns on military theory. Dubbed "the mahdi of mass" by B.H. Liddell Hart, Clausewitz believed that all things being equal - weapons, troop quality, and generalship, the side that had superior numbers would always win on the battlefield.² Therefore, in his military theory and others of that time, mass was all important. But that was more than 150 years ago, and there have been many changes to warfighting since then. Most of the changes affecting warfare can be organized into three broad categories: technological, conceptual, and ideological. In the last century and a half, technology has shifted the infantryman's capability from muskets to precision-guided munitions. Conceptually, military planners have included operational art as the intellectual activity linking tactics to strategy. Finally, national ideologies of democracy and socialism have affected the way commanders and statesmen relate to and conduct warfare. Given the qualitative changes brought to war by these factors, one would expect that ideas concerning generating and wielding mass would change also.

This monograph discusses the changing nature of mass as the tool of the American operational artist. The scope of this monograph is limited to studying conventional warfighting. Low intensity conflict (LIC), in any of its forms, will not be addressed. Additionally, only selected operations from the US Civil War, WWII, and Operation Desert Storm are discussed in the paper. Finally, doctrinal evidence is limited to official or institutional sources.

The first section of this three-section study discusses the physics of mass. It introduces mass as a scientific term and associated mathematical structure as this structure relates to military science. It also addresses the military theory of mass. This includes the ideas of Clausewitz and Jomini. The first section concludes with a discussion of the operational level of war and mass as the instrument of the operational artist.

The second section compares and contrasts US Army doctrinal and practical use of mass at the operational level. I will explore comparable and dissimilar aspects using three test criteria - means, effects, and tempo. The third section concludes the monograph with comments on the dynamic nature of mass, particularly with an eye towards future warfighting concepts. But before I look to the future, I will look to the past for guidance.

Attempting to bring order to the apparent chaos of war, early military theorists used science and logic to frame their ideas. Clausewitz and Jomini, in particular,

applied mathematical logic to develop their respective theories. Some of these early quantitative-based theories provided the basis for the US Army's doctrine and application of mass prior to the Civil War. However, as the US Army evolved after the Industrial Revolution, this principle of mass took on a different meaning that manifested itself in a unique American warfighting style - one of massed men and material. American warfighting during WWII in the European Theater of Operations (ETO) exemplified this application of mass. Yet from this same theater, new trends appeared, thereby setting the stage for further change at the operational level. Since Operations Just Cause and Desert Shield/Storm, it appears that the application of mass is again changing. Current doctrine calls for quick, decisive victory, while fiscal constraints require less men and material. In effect, the US Army is expected to obtain victory faster, with less resources and fewer casualties. This new warfighting imperative may cause mass and application methods to change.

II. MASS IN SCIENCE AND THEORY

Lack of science leads to chaos in art.

J.F.C. Fuller, 1926
Foundations for the Science of War³

Mass in Science

Fuller's comment indicates the importance early military theorists placed on applying scientific logic to

the chaos of war. The writings of Clausewitz and Jomini have similar emphasis in their descriptions of Napoleonic-era commanders. Mass, density, momentum, force, power, and energy were just a few of the terms they used.

Mass, in scientific terms, is defined as a unified body of matter - solid, liquid, or gas, with no specific shape.⁴ In the science of physics, mass is a measure of a body's resistance to acceleration. Other definitions include the major part of a physical volume or bulk of a set portion of a solid body.⁵

Density is the measure of mass contained in a specified volume. The formula for density is:

$$d = \frac{m}{v}$$

Eq. 1

where: d = density
m = mass
v = volume

One can see from this equation that if volume is held constant and mass is increased, density increases also. Conversely, if mass is held constant and volume increases, density decreases.

Momentum is the force that a moving mass exerts on anything that tries to stop it. The equation for momentum is:

$$p = mv$$

Eq. 2

where: p = momentum
m = mass
v = velocity of the mass

One can plainly see that if an object is moving faster or is more massive, it has more momentum and therefore is harder to stop. This is an important concept. Mass at rest (no velocity) tends to resist change. If a moving mass hits a stationary mass, one or a combination of four events may occur. First the moving mass may bounce off the stationary mass. Second, the stationary mass may move and the moving mass may stop. Third, the two masses may stick together and move. Finally, either of the masses may break into smaller pieces which move away from the impact area.

Momentum is a kind of force. Force is a measure of action, such as a push or pull, on an object. Momentum may start an object moving from rest or increase its velocity if it was already moving. Both of these movements are called acceleration. The equation for force is:

$$F = ma \qquad \text{Eq. 3}$$

where: F = force
 m = mass
 a = acceleration

Force is greater if mass and or acceleration is greater.

Work is a product of force and distance:

$$W = Fs \qquad \text{Eq. 4}$$

where: W = work
 F = force
 s = distance

Larger force and/or longer distance produce more work.

Finally, energy is a measure of potential force performed by a mass over a period of time. Mass has energy by virtue of its position, configuration, or velocity.⁶

There are numerous kinds of energy - kinetic, potential, or rest. This monograph is concerned only with the idea of potential energy available in a mass due to its position or configuration.

The equations are relatively simple. The important aspect of all these equations is that mass is the key -the common factor in all of them. Mass was also the common factor in Clausewitz's and Jomini's analyses of Napoleon's operations.

Mass in Theory

Some military historians believe that Napoleon's legacy to military theory was the genesis of operational art. Others believe he merely extended known tactics, techniques, and procedure to a higher level of execution, or that he extended the classical concept of strategy. This paper is not focused on this debate. Of importance is what Clausewitz and Jomini, both participants in operations for and against Napoleon, learned from their experiences.

The Napoleonic style of warfare was characterized by large armies, organized in combined-arms formations, supplied by unit foraging, and focused on the decisive battle. Napoleon used the "corps system" for controlling his armies. The corps system was nothing more than an extension of the division system founded by Francois de Broglie in 1760. The division system provided a pre-deployment formation for defeating the famous and well-

practiced Prussian battle deployment.⁷ Napoleon extended this to his corps system so that he could control his army for movement and battle. The corps system allowed Napoleon's forces to march dispersed and fight concentrated.

Napoleon's large armies also broke free from stationary magazines and depots. But to supply themselves with food, corps marched dispersed from one another along different routes. This facilitated living off the land. Marching along different routes decreased movement time. It also hid the bulk of the army, its location, and therefore Napoleon's aim. This was a significant benefit. Napoleon would receive information from his cavalry screen or units in contact with the enemy. This information allowed him to pick the place and time on the battlefield where he could direct the meeting of the bulk of his force. This location was based on terrain, enemy unit arrangement, and current battle situation. Napoleon was able to choose another critical element - the time in which to concentrate mass. He stressed the importance of time-distance relationships, particularly when it came to measuring the march rates of dispersed corps to a central meeting place. He had to make sure that the different corps arrived at the decisive place, at the same time.⁸

A useful analogy is that of a large water hose that allows water to move freely inside. Once the commander picks the decisive location, he aims the funneled opening.

The opening, by virtue of its smaller radius, speeds water velocity and increases density to this location. Units arrive nearly simultaneously, at the same location, densely packed. The corps system allowed Napoleon to control his large army and aim the momentum of this mass against his adversary's weakest point to achieve decisive victory.

The two most famous military theorists, Clausewitz and Jomini, participated in operations with and against Napoleon. Their experiences formed the basis for Clausewitz's On War and Jomini's The Art of War. Both observed consistent repetition of certain deployment patterns to achieve victory. For instance, Napoleon always concentrated a large part of his army against a lesser portion of his opposition's army.⁹ Clausewitz often found himself on the receiving end of Napoleon's energies and tried to understand the forces involved in this style of war.

Clausewitz wrote that war was an act of force to compel the enemy to do the state's will.¹⁰ The singular means of force employed by the state was the army. As Clausewitz surveyed the panorama of military history, he saw that the most common element of victory was superior numbers.¹¹ Yet Clausewitz had to account for battle outcomes where inferior numbers beat superior numbers, such as Napoleon's victory at Austerlitz. Clausewitz understood that it was not necessarily superior numbers alone that

decided victory, but superior numbers at the critical time and place.

This is an important point. Clausewitz, working from a fairly homogeneous European military history basis, understood that if two opposing armies were comparably equipped, trained, and organized, the commander who was able to choose the vital place and time would win.¹²

Clausewitz also understood that increasing the size of the army (gaining mass) was the easiest way to counterbalance enemy advantages in weapons, training, and organization. Therefore, he believed that as many soldiers as possible should be brought into the engagement at the decisive point. This was his "first principle of strategy."¹³ He wrote:

Since in strategy casualties do not increase with the size of the forces used, and may even be reduced, and since obviously greater force is more likely to lead to success, it naturally follows that we can never use too great a force, and further, that all available force must be used simultaneously.¹⁴

Clausewitz had more ideas about mass. He believed the price of victory was paid for by mass, that enemy mass needed to be destroyed, and that mass had limited endurance and cohesion. Clausewitz wrote that there was no victory without bloodshed.¹⁵ The willingness to expend the lives of soldiers to gain that vital location was the required cost for attaining victory.

Second, Clausewitz's concept of the center of gravity clearly demonstrates the importance he placed on

mass. The center of gravity was usually the concentrated mass of the enemy force and had to be attacked in ruthless fashion.

Third, his idea of culminating point illustrates that mass had limits on its employment. These limits were battle's bloodshed price, the army's logistical consumption of limited resources, and the diminishing martial spirit as the army moved away from the homeland. These factors contributed to a mass' limited endurance.

Clausewitz had one final point on the employment of mass. Lest anyone think he espoused using mass without any consideration of the situation, he wrote: "the maximum use of force is in no way incompatible with the simultaneous use of the intellect."¹⁶ The commander had to use his intellect, genius, or *coup d'oeil* to discern the vital place, determine the vital time, and then direct the mass of the force to that place, within a certain time frame.

Jomini, a member of Napoleon's "Grande Armee," observed the same mode of operations as Clausewitz. Like Clausewitz, Jomini observed that Napoleon avoided the deliberate, ponderous, and stylized maneuvers that his opponents employed. He also noted Napoleon's attempt to concentrate the bulk of the French force against one element of his enemy's force while holding the rest of the enemy at bay with the remainder of the French force.¹⁷ From these observations, Jomini derived his "one great principle," encompassed by the following maxims:

1. To throw by strategic movements the mass of an army, successively, upon the decisive points of a theater of war, and also upon the communications of the enemy as much as possible without compromising one's own.

2. To maneuver to engage fractions of the hostile army with the bulk of one's force.

3. On the battlefield, to throw the mass of the forces upon the decisive point, or upon that portion of the hostile line which it is of the first importance to overthrow.

4. To so arrange that these masses shall not only be thrown upon the decisive point, but that they shall engage at the proper times and with ample energy.¹⁸

These maxims provide a level of detail for employing mass not given in Clausewitz's "first principle of strategy." Jomini believed that mass had definite targets, should be maneuvered to overmatch a smaller enemy force, and be arrayed with "ample energy." Through creative genius, the commander could visualize those geographic points which, if seized or retained, facilitated the enemy's destruction. Additionally, the enemy's line of communication (LOC) afforded another target for mass. If enemy LOCs were threatened, the commander could force battle on the enemy under favorable conditions. However, Jomini understood that the enemy was not passive. The commander had to deploy his army so that decisive points against his force and his own LOCs were guarded in some fashion. This required deploying elements of the army away from the bulk or mass. One could not safely campaign with a single, united, amorphous mass.

Secondly, at that decisive point or where conditions were favorable for decisive battle, the commander had to make sure his mass was significantly larger than the enemy he planned to engage. In Jomini's words, "bulk" against "fractions." To keep the enemy from uniting his own mass or moving it to the decisive point, there had to be a fixing or holding force. Jomini therefore starts to paint a picture of coordinated operations between a guard force, fixing force, and mass. This generally coincides with Napoleon's deployment of mass. For example, David Chandler, author of The Campaigns of Napoleon, used the following terms to describe Napoleon's use of mass:

masse primaire - force used to pin the enemy and prevent deployment elsewhere, if possible force enemy to deploy reserve here.

masse de manoeuvre - force used to turn flank, threaten rear, and roll up the enemy's battle line.

masse de rupture - the reserve, used at the critical place and time, brings quantitative and qualitative edge to the commander at critical place and time.

masse secondaire - a secondary force fighting in a less important secondary sector.¹⁹

Jomini's third maxim stated that any force had to be arranged for maximum "energy" output. From the preceding section of the science of mass, an object has potential energy by virtue of its position and/or arrangement. Jomini knew that an army's main source of energy came from the infantryman. Therefore, infantry unit arrangement had to maximize the amount of fires into the enemy. This is why

order of battle, also known as disposition of battle, was so important to Jomini. Based on the situation, a commander might arrange his mass into orders such as parallel, oblique, concave, or convex. Each one of these orders of battle maximized the number of firers based on the enemy disposition and the approach direction (relative position) of the commander and his mass.

The final mass-related observation Jomini drew from Napoleon's operations dealt with lines of operation. Lines of operation connected the base of operations (where mass drew its sustainment from), mass, and objective points (points whose retention or seizure facilitates freedom of action and achieving victory).²⁰ Lines of operation give a force its directional orientation, relative to the enemy. Just as in physics where force is a vector with direction and magnitude, here force has a direction and size or mass.

The fundamental observation that both Clausewitz and Jomini derived from Napoleon's operations was that mass (infantrymen carrying muskets) had to be concentrated at one particular place and time. The implications of this observation can best be explained using scientific terminology explained earlier.

The commander moves his mass within the volume of the theater of operations. The mass is dispersed for logistic and security reasons. Based on the situation, the commander determines where the decisive point and time are located. He then increases the density of the mass by

bringing the mass from an area to the decisive point. At this point of contact, the moving mass's momentum acts on the enemy's resistance to movement. Additionally, the commander positions and arranges his mass so that maximum energy can be directed at the enemy. This is the essence of the principle of mass (or concentration as the British call it). This warfighting concept has been called "strategy of the single point."²¹

US Civil War - Point of Departure

Prior to the Civil War, US Army officers and their European counterparts shared the same understanding and practice of mass. Dennis Hart Mahan probably contributed most to this common understanding. Mahan graduated from the United States Military Academy (USMA) in 1824, was commissioned an officer and appointed as professor of Engineering. His first project was to study public works and military instruction in France for four years.²²

During his studies in France, he developed a keen admiration for the French military. This manifested itself in his enthusiastic study of Jomini's interpretations of Napoleonic warfare. Jomini's theories particularly attracted Mahan because of their order, logic, and scientific appeal.²³ In the years prior to the Civil War, Mahan taught the military art and the science of war to a majority of the cadets who would be senior leaders during this conflict.²⁴ Because of the Jominian influence in his

teachings, his many students (Grant, Sherman, and others) practiced a European style that retained Napoleonic concentration and decisive point focus through the majority of the Civil War. However, the Industrial Revolution and the manpower it freed from agricultural duty to participate in large armies caused this practice of mass to evolve away from its Napoleonic origin and develop into a unique American style.

Dr. Bruce Menning, noted author of Bayonets before Bullets, reminds us that any systematic approach to military history promotes the understanding that economic development significantly influences strategy.²⁵ Nowhere is this more telling than in the influence of the Industrial Revolution on the Union Civil War strategy developed by General U.S. Grant. The revolution brought to Grant an institutionalized growth process, abundant resources, and a strong production base.²⁶

The actual industrial innovations which have been acknowledged as the prime drivers during the Civil War were the railways, road networks, electronic telegraph, improved time pieces, and rifled muskets.²⁷ Railways sped the strategic deployment of large army formations to theaters of operations and thereby reduced "wear and tear" (i.e., friction) on the force. This also meant formations could be shifted relatively quickly from one theater to another and arrive in better fighting shape. Railways also increased the logistic capability from the sustaining base to the

rear of these fighting formations. Railways became the "bones of strategy."

The road networks were designed to ease transport of goods and people between communities. Also, once these large formations were in the theater of operations, these same roads promoted distributed movement. It was now much easier to split the larger formations, control them, and accurately gauge their movement times.

The electronic telegraph connected armies within theaters of operation and within theaters of war.²⁸ It enabled a centralized headquarters to command and control distributed army formations. This centralization allowed still larger formations to be formed without the close assembly required by a slow command and control system. The telegraph, along with improved time pieces (aiding synchronozation) "harmonized" large unit actions over extended distances.²⁹

The final industrial innovation that affected the Napoleonic mass concept was the mass-produced, rifled musket. Large armies could now be fielded with relatively long-range, accurate rifles. This greatly increased the potential firepower energy of the individual soldier. Armies became more efficient at killing. The lethality effect on concentrated formations of men was tremendous. Casualty counts mounted swiftly for the attacker, yet during the majority of the Civil War both sides continued to mass according to the Napoleonic practice.

The net effects of these four innovations were fourfold. First, these large formations, called army groups, needed space to operate. If for no other reason, commanders of large army formations were compelled for logistical reasons to keep distance between their formations and others. Second, splitting the entire army up was no longer dangerous. These formations were too large to be destroyed in one short battle. The telegraph sped enemy information, battle orders, and movement and the railway sped reinforcements. Third, the railway system linked the production and sustaining bases to the battle front. This connected a nation's economic force to its military force, making war a total effort and creating modern day rear areas. Included in this linkage was the reorganization of the logistic structure. Soldier loads and rations were standardized and the railways came under centralized control. Finally, the Napoleonic concentration lost its impact.³⁰ The enemy's concentrated masses withered in the face of the defender's increased firepower. Concentration had to remain dispersed and frontages extended, giving rise to an "empty battlefield."³¹

Regardless of the technical innovations brought to the battlefield by the revolution, neither Union or Confederate generals saw any reason to change from the European concept of mass. It took three years of bloody battle before Grant took charge of all Union armies, unified northern strategy, and began to change the American

concept of mass to something unique. Grant's campaign of 1864 readily illustrates this.

In this campaign, Grant tied together all Union theaters of operations and integrated operations under a single strategy of divide and conquer.³² Union army groups would go on the offensive in multiple theaters of operation, apply continuous pressure on the Confederate forces, and destroy enemy resources along the way. The army groups of Sherman and Meade provide examples. First, Sherman would fight the Confederate Johnston in Georgia and keep him from linking up with Lee in Virginia. Additionally, Sherman would split the south and destroy Confederate resources along his route from Atlanta to Savannah. Second and most important, Meade would focus offensive operations on Lee's army with the aim of destroying it. Grant's strategy was to crush the south through weight of numbers. Grant's concept of operations was unique. In his post-war report to Secretary of War Stanton, he provided a map with "occupation" lines.³³ This graphic display created the impression of continuous pressure throughout the theater.

To digress for a moment, what Grant's strategy pictured was a "new" equation for military scientists:

$$P = \frac{F}{a} \quad \text{Eq. 5}$$

where: P = pressure
F = force
a = area

Grant sought to engage the Confederacy over an extended area, apply superior numbers along this area, and crush the enemy through continuous pressure. Grant did not seek to unite all Union armies in one theater, search for a weak point in Lee's army, and attack and destroy him as the Napoleonic concept of mass called for. Instead, Grant directed Meade to maneuver against Lee to create a decisive point. But those attempts failed during the Wilderness, Spotsylvania, North Anna, and Cold Harbor battles. Nevertheless, the mass of this Union force allowed Grant to repeatedly wear down Lee's army, while Sherman's efforts prevented Johnston from joining Lee. After nearly a year of continuous pressure along different fronts, Lee and the Confederacy surrendered.

The legacy of this campaign was threefold. First, mass required significant superiority in terms of men and equipment. Second, the pressure of mass along an extended front might create more numerous, but less decisive points.³⁴ If this was not successful, at least the enemy was prevented from concentrating forces. Finally, mass created and wielded in this fashion could win without the subtleties of maneuver. Mass no longer had to be concentrated and maneuvered to the single decisive point to achieve strategic victory. The American practice of mass became conceptually different from its European brother. This new application also, according to some military theorists, coincided with the beginning of operational art.

Operational art is the military intellectual activity that joins tactics and strategy. Its purpose is to put together sequential and simultaneous operations, grouped together to form campaigns, to achieve strategic objectives.³⁵ It arose from the military's necessity to fight less decisive battles while still striving to obtain strategic objectives. U.S. Grant understood that the traditional decisive, concentrated battle, the battle which decided the outcome of the war, could not be attained. So he planned operations, both simultaneous and in sequence, to attain the same results.

As Schneider wrote in his paper, "The Theory of the Operational Art," planners at this operational level work in a medium, using tools, wielded in an creative method.³⁶ The US operational artist appreciates the evolving tool discussed in this monograph - mass.

III. ANALYSIS AND EVALUATION

The preceding sections introduced the scientific basis for mass, the Napoleonic theory and application of mass, and the point of departure for a distinct American practice of mass. The purpose of this section is to determine if qualitative changes have occurred in the use of mass by US operational artists and resulting implications for the future. I will judge change from the "baseline" use of mass at the operational-level in Grant's 1864 campaign. Two campaigns, WWII ETO and Operation DESERT

STORM will be analyzed along with the operational-level doctrine that was available at the time. To analyze the doctrine and campaigns, I will use three test criteria: means, effects, and tempo.

Test Criteria

The first test criterion, *means*, refers to the different resources or components of the military organization available to the operational artist for use in battle. The second criterion, *effects*, describes the force produced by the interaction between mass and the enemy. The third and final criterion, *tempo*, describes the cadence or rhythm of employing mass. Putting these criteria together in equation form gives: *effects* = *means* applied with *tempo*. Using terms from the preceding science section provides: Force = mass x acceleration (Eq. 3).

1864 Campaign as Baseline

The "baseline" employment of mass, characterized by Grant's 1864 campaign and described in the last section, had three aspects. First, mass required significant superiority in terms of men and equipment. Second, the pressure of mass along an extended front might create a decisive point and time. If it did not, at least the enemy was prevented from concentrating forces. Finally, mass created and wielded in this fashion, could win without the subtleties of maneuver. Mass no longer had to be

concentrated and directed at finding the tactical decisive point from which came strategic victory.

At that time, the means of mass were infantry, supported by artillery and cavalry, organized into large formations. Once moving along a planned direction and colliding with the enemy, mass could have two effects. The desired effect was annihilation - the destruction of large numbers of enemy troops and equipment over a relatively short period of time. Failing this, the other effect was exhaustion - wearing down the enemy through continuous pressure along a large front over a longer period of time. Obviously the tempo for annihilation was a single operation with strategically decisive results. The normal tempo for exhaustion was successive operations in depth and simultaneous operations in breadth. Successive operations in depth, one after another in a particular direction, allowed no respite to the enemy. Simultaneous operations along the front prevented the enemy from economizing force and creating a concentrated mass in another area of the theater. This is the standard from which change in the operational-level use of mass can be measured. The next step is to examine pre-WWII doctrine available to the US operational artist.

WWII European Theater

Michael Metheny's "The Development of the Theory and Doctrine of the Operational Art in the American Army, 1920-

1940," identified numerous doctrinal sources available to the US operational artist of the period. These sources provide insight into the theory behind the use of mass at the operational level.

Doctrine

Means

A cursory review of operational-level doctrine and writing reveals a distinct Napoleonic mass influence up to WWII. As late as 1930, the US War Department still recognized that men were at the center of the war-making machine.³⁷ Just as Clausewitz identified numerical superiority as the key ingredient for victory, so did doctrine writers at the Command and General Staff School (CGSS) in the mid-1930s.³⁸ But numerical superiority did not mean counting all men in the military, rather it meant counting men at the front.

Doctrine called for the US operational artist to wield mass in order to concentrate combat power. Combat power was a function of leadership, numbers of men, their equipment, their tactical skill, their fighting ability, and their willpower.³⁹ Not only should mass be concentrated, but it also should have definite arrangement. Charles Willoughby, author of The Element of Maneuver in War (1935), described the various arrangements of mass that maximized combat power. His diagrams had a distinct Jomini-inspired appearance.⁴⁰

Effect

The desired effect of mass on the enemy was destruction. This theme is echoed throughout pre-WWII institutional sources, to include CGSS curriculum, and US Army doctrine. The principle CGSS text used to train future large unit commanders just prior to WWII was Principles of Strategy for an Independent Corps or Army in a Theater of Operations. This text stressed that the large unit commander must "be imbued with the spirit of annihilation and must strain all efforts such that each battle will become a decisive and overwhelming victory for his troops."⁴¹ The unit commander was to achieve this overwhelming victory through the largest concentration of combat power. The effect sought is not "dislocation" or "paralysis." One director of CGSS went so far to say any idea of placing the enemy in a situation where he says "What's the use?" was fanciful thinking.⁴² The aim was complete ruin of the enemy and his equipment. This focus is also found in the doctrine of this time.

Field Service Regulation Operations (Field Manual 100-5) 1923, stated that the final object of military operations was the destruction of the enemy force.⁴³ Such destruction was the surest way to force the enemy to call for peace. The 1941 version of the same manual called for the "simple and direct" application of force to achieve the enemy's destruction.⁴⁴ But it is the companion manual, FM

100-15 Field Service Regulations for Larger Units (1942)

that linked the effects of air superiority to the destructive ground effects of mass.

This pre-WWII field manual stressed the importance of air operations beyond the sphere of action of the ground force. Correct use of airpower's destructive effects in the enemy's rear could lead to ground force's increased effectiveness.⁴⁵

Tempo

Tempo refers to the rhythm or cadence of operations. In Napoleonic warfare, commanders strove to create and terminate wars in one single decisive battle. This *tempo* became obsolete with the rise of groups of armies. Even if one army was destroyed, the nation-state could still wage war. Therefore, battles became less decisive and more numerous. *Tempo* had to expand to include successive and simultaneous operations.

Early versions of FM 100-5 Operations (1923) discussed units distributed in width and depth. In the supporting mission area, units were distributed in width with extended fronts. In this fashion, pressure could be applied simultaneously along the front. In the primary mission area, units were distributed in depth with narrow fronts so that pressure could be applied continuously in a primary direction.⁴⁶ FM 100-15 (1942) stated that commanders had to plan successive operations to follow up

initial success. A Manual for Commanders of Large Units (FM 100-15, 1930) originated this guidance. It said that if the enemy conducted a well-coordinated defense, offensive operations should be conducted in a "step-by-step" forward movement.⁴⁷

In summary, the pre-WWII US doctrine had a confusing dual nature. The American Civil War and WWI taught American planners that victory belonged to the nations that successfully mobilized social, economic, and military strength. The means of mass remained infantrymen and their rifles and bayonets. The effect of mass was destruction, not the maneuver-caused paralysis or dislocation described by WWI-ravaged British theorists J.F.C. Fuller and B.H. Liddell-Hart. Mass was to be used in successive operations in-depth, while simultaneous operations occurred across the front. Yet there remained the idealistic Napoleonic concept of achieving decisive strategic results in a single battle, through concentration at a point, dramatically reducing the duration of the war.

Application

From the American point of view, unconditional surrender, and the totality of victory required to enforce it on Nazi Germany, required direct attack with overwhelming mass and material. Marshall felt that any other strategy would be a waste of time.⁴⁸ American strategists, backed by unparalleled resources and their

Civil War inheritance, had confidence in a "head-on" application of power.⁴⁹ America would reduce all enemy capabilities simultaneously or in succession.⁵⁰ Evidence for American strategists' different concept of mass and their confidence of success lies in the nature of Operations OVERLORD and DRAGOON. Operations OVERLORD, DRAGOON, and subsequent operations were very similar to operations in Grant's 1864 campaign, which saw mass extended from the James River in Virginia to the Gulf of Mexico.

Means

The means for OVERLORD came from four million US and allied troops, five thousand ships, and thirteen thousand airplanes.⁵¹ The requisite infrastructure was present also: 163 airfields; 50,000 vehicles; 94,000 hospital beds; 1,000 locomotives; and 20,000 rail cars. Approximately 1.9 million tons of supplies flowed to Britain each month.⁵²

Organizationally, each allied army corps was structured with enough tanks and vehicles to make it equivalent to a German Panzer Corps. Therefore, as the

As built up the OVERLORD lodgement area, each corps had the potential energy to penetrate enemy lines and perform exploitation operations. The successful invasion set the stage for an incredible American demonstration of mass, directed across a broad front which included three army groups of fifty-seven maneuver divisions and two numbered

air forces.⁵³ Logistics and deception also played a role in the means of mass.

The allied invasion force, powered by American industrial strength, was totally motorized and capable of quickly replacing losses. Marshall said that the greatest allied advantage was its 2 1/2 ton truck. The US supplied 2.4 million trucks of all sizes to the allies. The Germans had only 346,000 trucks.⁵⁴ This logistic mobility advantage allowed the allies to supply rapidly the front line forces with the maximum amount of equipment and supplies. Losses, even those sustained during the German Ardennes Offensive, could be quickly replaced. In this offensive, Hitler's strategic answer to OVERLORD, the allies lost 81,000 casualties; 134 aircraft; and 800 tanks. The Germans lost approximately the same. However, the allies could make the losses up in two weeks. The Germans could do little to replace their losses. As early as 17 July 1944, Germany could only muster 17 replacement tanks for 250 losses.⁵⁵

American deception plans actually multiplied its military mass. Hitler and his high command believed that the main invasion location would be Pas de Calais. Allied planners reinforced this idea. Hitler ultimately positioned nineteen divisions from his 15th Army in this area.⁵⁶ This reduced the mass of the enemy in the Normandy area and increased the relative force strengths in the invasion area.

Effect

GEN Eisenhower's mission was to invade the continent of Europe and destroy Germany's armed forces.⁵⁷ The almost theater-wide, extended-mass front produced by OVERLORD and DRAGOON, combined with the continual flow of supplies and replacements to this front, and relentless combat along the front, stretched the German forces to their limit. One German general said that the front was so wide and destructive that officers could no longer maintain effective control of their men.⁵⁸ The allied destructive power was so great that the Panzer Lehr Division, an elite tank division, dug in for the defense and parked the tanks 60 miles to the rear as a safeguard from artillery and bombers.⁵⁹

Like any massive object though, the mass of forces in OVERLORD took time to get moving. Inertia was large for such a force. Breakout operations by the British and American forces set up conditions for unleashing the potential energy of this great allied force. Once the breakout occurred, the momentum of the invasion mass was too great to stop. Conquered German commanders were unanimous in the interviews. They said it was not "strategic vision, tactical adroitness, or superior soldiers, but simple material weight" that defeated them in the west.⁶⁰

However, sometimes destruction and not paralysis or dislocation proved to be counterproductive. The extended-front push following the breakout failed to close the Argentan - Falaise pocket. Of thirty German divisions, remnants of twenty-six escaped to fight again and only one disappeared from the German order of battle.⁶¹ Had senior American or British understood the opportunity, concentration of mass at a point could have annihilated these divisions.

Tempo

The tempo of operations was at times successive, simultaneous, and continuous. OVERLORD and DRAGOON are examples of successive operations, as are the breakout operations GOODWOOD and COBRA. Also, for the first time, airpower played a significant role in successive operations. As early as April 1944, elements of Ninth Air Force (US), began to "isolate" the invasion coast by destroying key bridges and rail centers. These operations significantly decreased German ability to shift reserves.⁶² OVERLORD planners also sought to take advantage of US strategic bombing operations. These operations, begun before OVERLORD and continuing throughout, affected fuel production and transportation networks.⁶³

The allies attained simultaneous operations by employing ground units across the front, air forces in depth, and service and supply units in the rear. Eisenhower

could have concentrated the British 21st Army Group and American 12th Army Group into a 40-division mass, and subsequently penetrated through Belgium into the heart of industrial Germany. Instead, he opted to use the available road networks, protect operational-level flanks, and cause the enemy to disperse laterally by taking a broad-front approach.⁶⁴ As the allied force continued to grow and link-up with DRAGOON's 7th Army, Eisenhower would employ three army groups (one British and two US) simultaneously, across the European theater.⁶⁵ Each army group's objectives were tied to his broad front pressure strategy.

Air Force operations were conducted simultaneously with ground force operations. Air interdiction operations caught hundreds of German vehicles on roads moving to counterattack. These air operations were so effective that one historian wrote that there were no serious German counterattacks formed at division or above.⁶⁶ These operations in depth proved very frustrating to the Germans. At the Battle for Hill 317, for example, Hitler ordered seven German division to counterattack to close the American penetration at the Avaranches Gap. A combination of four divisions made it to the general area, but only one division actually made it to the objective area. The allies then destroyed this remnant of a division by combining artillery, naval gunfire, and close air support.⁶⁷

Logistical operations occurred simultaneously across the front and replenished the energy expended by broad-

front mass combat. No unit was inactive for long. There was constant requirement for supplies. In one month, service and supply units moved 36,000 small arms; 500 tanks; 2,400 vehicles; 100 artillery pieces; 8,000,000 artillery and mortar rounds; and put in 66,400 miles of communications wire.

Finally, operations were relatively continuous. At the tactical level, there were situations when German units escaped destruction because American units moved too slow. However, at the operational level, the Germans were significantly affected by broad-front simultaneous operations and in-depth successive and simultaneous operations. As German fighting units were destroyed through these combinations, Hitler had no time to reconstitute replacements without depleting his planned Ardennes counteroffensive. By December 1944, Hitler was reduced to using newly organized divisions whose troops had only six weeks training.⁶⁸

In summary, it took the US two years to build up the means of mass to fight an industrialized Germany -superior numbers of equipment; ground forces organized for frontal assault, penetration, or exploitation; strategic bombing forces; and the infrastructure to support it. The effect remained virtually unchanged from Grant's time - destruction through firepower. Tempo expanded from simultaneous and successive to include continuous.

Grant's strategy was reaffirmed - hit the enemy with advantage at several places and thus force him to "accentuate his weakness through dissipation."⁶⁹ In the course of the war, America built enough air, land, and sea equipment, that if totaled, equaled 588 armor divisions or 2,000 infantry divisions.⁷⁰ America won because she had fought under the principle of "survival of the fittest."⁷¹

The basis of American operations in the WWII ETO lay in the unique American perception of mass, begun 80 years earlier. Yet, the full mechanization of the American military effort in WWII laid the foundations for further evolution of mass. Airpower, epitomized by air interdiction, carpet bombing, and strategic bombing, pointed towards mass firepower. Maneuver, as well as superior weapons and tactics could significantly increase the operational level effectiveness of mass.⁷² Finally, logistics would grow in importance to the operation-level commander as the supporting foundation for sequential and simultaneous operations over broad fronts. Without a robust logistic system, mass had no reach or endurance.

Operation Desert Storm

Forty-five years later, US operational artists had another chance to employ mass. Operational-level doctrine and practice had changed. US practitioners of mass would seem to have taken General Halder, a German WWII commander's advice. He said, "material superiority led

Americans to display a tendency to underestimate the importance of surprise, maneuver, and improvisation."⁷³

Doctrine

Means

Field Manual 100-7, The Army in Theater Operations states that the operational-level of war is "inherently joint, possibly combined."⁷⁴ Therefore the means of mass at this level consisted of army and air force warfighting units and possibly navy and marine units. Additionally, other nations could contribute by providing their military forces. The other great change to mass was doctrine's acknowledgement that weapons contributed greatly to mass. According to FM 100-5, Operations, mass was the concentration of combat power at the decisive point and time.⁷⁵ Combat power was a combination of maneuver, firepower, protection, and leadership.⁷⁶ In light of the joint nature of operational-level mass, the means of mass took on a different character than before. Technology allowed firepower to be generated from different media - air, sea and land and to be massed on the enemy on land. Against enemies not similarly equipped, US joint forces could operate with impunity, thereby creating the potential for great destructive efficiency.

Effect

FM 100-5 characterized the effect of operations directed against the enemy as "powerful blows that will

degrade the coherence of enemy operations."⁷⁷ Operational-level formations would maneuver rapidly, conduct violent, unpredictable operations that would "disorient" the enemy.⁷⁸ Since this particular manual epitomized the US Army's fixation with the Soviet Union's numerical superiority, it mentioned "destruction" less, and instead included terms such as "disruption", "dislocation", "disorient."

Tempo

US Army doctrine writers believed that the *tempo* of modern operations would exceed that of the past. Technology made tactical mobility and lethality more efficient. The effects of mass had to be synchronized in time and space to end battles quickly and successfully. This meant that the different components of mass had to be able to operate successively in time and simultaneously in depth. The framework of "close, deep, and rear" organized battlefield activities so maximum relative combat power could be produced at the right place and time.⁷⁹

Operations in the rear produced freedom of action for the operational-level commander. Logistics and security operations provided continuity of operations. This meant that the means of mass could operate longer and farther, without slowing down or being constrained.⁸⁰ Rear operations significantly affected subsequent operations.⁸¹ On the other hand, deep operations created the conditions

for victory by influencing the outcome of close operations. This was done through delaying, disrupting, or destroying key enemy units or functions. These operations significantly affected the outcome of close operations.

From pre-WWII doctrine to pre-DESERT STORM doctrine the means of mass expanded from the infantryman to the weapons system, and from the army to air, land, sea, and combined forces. The effects of mass changed from a direct method of destruction to an indirect method of dislocation and disorientation. Finally, doctrine institutionalized successive and simultaneous operations.

Nowhere is this clearer than US operations in Operation DESERT STORM from January to February 1991.

Application

Means

The mass of the Iraqi Army inside the Kuwait Theater of Operations (KTO) consisted of 30 committed and 8 uncommitted divisions totaling 4,200 tanks, 2,600 Armored Personnel Carriers (APCs), and 3,100 artillery pieces.⁸² Arrayed against this force was the mass of the US-led coalition forces. In this theater, US operational artists drew from air, land, sea, and space forces.

The geography of the KTO and Iraq's low-threat naval presence allowed US operational artists a unique advantage - the ability to launch air and missile strikes from sea platforms without any similar Iraqi response. A similar

asymmetric mass-matchup occurred after coalition air forces destroyed Iraq's air force and integrated air defense network. The final asymmetric matchup occurred in space. The US operated intelligence collection and communications systems in space, uninterrupted by any Iraqi means. Although the Iraqis had four mediums in which to fight, they were constrained to the ground by their own force structure limitations or coalition combat operations. This led to terrific operational-level advantages for coalition forces. Operational artists could focus four different means of mass - air, land, sea, and space - on to a single enemy mass on land.

Added to this significant mass advantage, coalition forces also made good use of "combat multipliers." Combat multipliers are those actions which increase the basic combat power of a unit. For instance, Psychological Operations increased the combat power of ground units by influencing thousands of Iraqi soldiers to surrender without fighting. Electronic Warfare shut down radio communications within Iraqi ground units and prevented synchronized combat operations. Deception also caused the Iraqis to hold five divisions on the coast for an expected Marine amphibious assault.⁸³ But the largest multiplier for the coalition ground mass was maneuver.

At the tactical level, maneuver is a component of combat power and inseparable from firepower. At times, units maneuver to bring superior firepower on the enemy. At

other times, units must use firepower to break the enemy and gain the freedom to maneuver. However, in Operation DESERT STORM, maneuver significantly increased the operational-level potential energy by placing a significant ground mass in a position superior to that of the enemy. The clandestine moves by the XVIII and VII Corps to the west, their penetration of the lightly held front line, and subsequent envelopment placed these two corps on the flank or rear of most of the enemy's mass. Instead of fighting through directly to gain this positional advantage, operational artists chose instead to maneuver around, thereby incurring no casualty cost and surprising the enemy.

Effect

The effect of the interaction between the coalition mass and the enemy was singular. The desired effect was destruction of the Iraqi offensive military capability, while minimizing casualties.⁸⁴ This entailed two different, but related actions.

The first action was the operational-level defeat of the Iraqi defense plan. Operational artists had to find some method to employ mass that would unhinge the Iraqi defense plan. Since the enemy plan was based on a strong, centralized command structure, an "indirect" application of mass could immobilize the enemy operational-level leaders. This would force tactical-level commanders to act without

orders or guidance from their higher headquarters. In turn, the operational plan would come apart. Therefore, the enemy command, control, communications, and intelligence (C3I) network was a high priority target for the coalition air and US naval forces.⁸⁵

The second action contributing to destruction was the tactical-level application of firepower. Phase Four of coalition air operations consisted of destroying enemy ground forces.⁸⁶ In this phase, air forces directed their efforts at destroying enemy tanks, APCs, and artillery, thereby setting the conditions for ground mass employment. Ground force units were also "force-oriented." Of the six different land forces, all had missions to fix or destroy enemy forces within their zones of responsibility. For example, Joint Forces Command East and North (Saudi, Qatari, Egyptian, and Kuwaiti ground forces) attacked to destroy or fix enemy forces in their zones. VII Corps had the mission of destroying Republican Guard Forces in its zone. XVIII Corps had the mission of blocking escaping enemy forces and assisting VII Corps in its destruction mission. Combined air and land operations succeeded in destroying 3,800 tanks, 1,450 APCs, and 2,900 artillery pieces.⁸⁷

Tempo

In combination with immobilizing the enemy command capability, US operational artists sought to set a rapid

operational tempo. Operations were designed to be simultaneous in time across the front and in depth and also successive in time and depth.

On February 23, 1991, coalition land forces stretched 300 miles from the Persian Gulf and west to the left flank of the XVIIIth Airborne Corps in the vicinity of Rafha.⁸⁸ The ground war commenced with synchronized attacks in the east with coalition and US forces, to be followed by attacks in the west by US, French and British forces. After less than 12 hours, simultaneous attacks occurred across this 300-mile front. Coalition air forces conducted simultaneous in-depth operations by interdicting Iraqi lines of communication and attacking second echelon forces. At the same time, US ground forces conducted their deep and close operations.

Land forces performed successive operations in-depth in the east while they attacked in zone towards Kuwait City. These forces executed a direct approach through the heart of the Iraqi echeloned defense. This operation kept enemy forces in place with their attention focused to their front. Second, XVIIIth Corps maneuvered north, secured the far west flank and sealed off escape routes across the Euphrates River. Third, VIIth Corps maneuvered north to the west of Republican Guard Forces to destroy them.⁸⁹ This tempo was designed to be rapid and in fact accelerated, as Iraqi forces disintegrated before the synchronized air, land, sea, and space operations.⁹⁰ In

fact, over the relatively short time period of four days, the ground operation looks very much like a single decisive battle.

In Operation DESERT STORM, the means of mass encompassed the air, land, and sea formations of US and allied nations. Operational artists also planned actions which increased the combat capability of units and degraded that ability of the enemy, thereby creating mass larger than the sum of its parts. The effects of mass remained destruction, but there was a psychological element of dislocation involved also. Finally, the tempo of operations was rapid due to successive and simultaneous operations.

One must be careful not to draw too many conclusions from this particular episode or any conflict in general. Each war discussed in this paper had aspects and situations which make it unique. Nevertheless, by comparing the means, effects, and tempo of mass, one can see that mass has changed over time.

The means of mass has changed from infantrymen with musket and bayonet to joint and combined formations of combat power. The effect of mass remains a curious blend of a desire for annihilation in a quick decisive victory, and the desire to force exhaustion on the enemy. Finally, tempo has evolved from simultaneous and successive to simultaneous, successive, and continuous (see Summary Chart).

TEST CRITERIA SUMMARY CHART

	MEANS	EFFECTS	TEMPO
1864 Campaign	Infantrymen	Annihilation Exhaustion	Single Operation Simultaneous - width Successive - depth
WWII ETO Doctrine	Men	Annihilation Destruction	Single Operation Simultaneous - width Successive - depth
Application	Men, Equipment	Destruction	Simultaneous - width Successive - depth Continuous Logistics
Desert Storm Doctrine	Joint and Combined combat power	Disrupt, Defeat, and Destroy	Simultaneous - depth Successive - time
Application	Joint, Combined, and Asymmetric combat power Maneuver	Disrupt C2 Destruction	Simultaneous - time, width, depth Successive - time, and depth

IV. CONCLUSION

The National Security Strategy, dated January 1993, states the "capability to generate decisive combat power, if and when needed, strengthens our ability to terminate a given conflict swiftly on terms favorable to us and with minimum loss of life."⁹¹ The Clausewitz quote used in this paper's introduction suggests to US strategists that if they keep quick decisive victory as the goal, then maintaining the capability to generate this decisive combat power must influence their preparation for war. Yet as the government continues to "build down" its military forces, one begins to question if the tool of the US operational artist will emerge significantly different than the mass of the past.

In the past, US operational artists wielded superior mass in a search for the single decisive battle of annihilation, yet the American practice of mass suggests that enough mass needs to be present to wage longer wars of destruction. GEN Starry, former TRADOC commander, wrote that commanders conducted operations on the basis of certain operational concepts.⁹² If this is true and the US military mass is decreasing, we can expect the rise of other aspects of operations to increase the effectiveness or efficiency of mass. Operation DESERT STORM provides a glimpse of these aspects - maneuver, asymmetric attack, and combined operations. One would expect that these same

trends will be present in future operations, along with other "creative" operational-level mass multipliers.

This paper has traced the development of the American employment of mass from its Napoleonic genesis, its theoretical basis in Clausewitz and Jomini, and the American Civil War as the point of departure for a distinct use of mass. By looking at two major theaters of operations and the supporting doctrine of the time, this study demonstrated the changing nature of the American concept of mass. Obviously technology has influenced the means of mass and US operational artists have grown more sophisticated in warfighting. Yet have operational planners let go of the "more is better" mentality? If the American mass is decreasing, planners must develop the capability to better maneuver, deceive, and surprise the enemy in order to achieve the sought after quick, decisive victory.

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